Revisiting the Childcare Gap Between High- and Low-Skill Mothers *

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Abstract

Information diffusion on the importance of early child development has been growing fast starting from the mid-1990s. At the same time, childcare hours have increased, especially for mothers of very young children and the high-educated. I argue that information diffusion on the importance of early investments coupled with increasing income inequality plays an important role towards rationalizing some of the trends in childcare time and the widening of the education gradient in childcare hours at different ages of the child's lifecycle.

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"It took very little time on the ground in America before I found myself becoming unrecognizable. I bought an SUV. I signed my unathletic elder daughter up for soccer. [...] I bought a small library of pre-K skill books.

I went around in a state of quiet panic."[1]

1 Introduction

Mothers of the recent generations are more likely to participate in the labor market, at the expense of leisure and housework time. Mothers today also spend more time with their children relative to the past. The difference is more pronounced for high-skill, high-earning mothers. The overall increase in childcare hours and the widening of the gradient by education dates back to the 1990s and has since been puzzling to economists.

In this paper, I revisit some of the evidence on the evolution of childcare time and the explanations that have been given to such changes. Two facts related to the evolution of childcare time are worth explaining. First, the overall level of childcare time has increased relative to the past, especially for the high-educated. Second, the increase has been heterogeneous for children of different ages. Whereas for cohorts of children born in the 1980s the relative focus was at older ages, for children of the recent generations childcare time is much higher at young ages. Previous research has focused on the first fact, but not on the second.

The increase in the level of childcare hours and the widening of the education gradient have been related to the increase in returns from human capital, and the comparative advantage of college-educated parents in supplying educational childcare (Ramey and Ramey, 2010). I argue that if complementarities between time and money exist, spending inequality can rationalize the increase in the level of childcare time spent on older children by the high-educated. At older ages, monetary investments are particularly productive, and complementarities with parents' time may exist: high-quality education, extracurricular activities, and enrichment goods need

[1] Excerpted from "Perfect Madness: Motherhood in an Age of Anxiety," by Judith Warner.

coordination and planning. Therefore, spending inequality in the late 1980s and early 1990s can rationalize the increase in childcare time spent on older children by high-educated parents.

I then show that neither increasing returns from human capital nor spending inequality are sufficient to explain the large increases in childcare time at very young ages documented for the cohorts born after the 1990s. I argue that information diffusion on the importance of early investments and on the complementarity of investments across the lifecycle can play an important role towards rationalizing the choice to allocate childcare time at young ages.

The paper is divided into two parts. In the first part, I establish the key facts that motivate the research question and analysis in the paper. First, I use historical time use data from the American Heritage Time Use Survey (AHTUS) to revisit some of the recent findings on the evolution of childcare time. The literature analyzes trends in parental time by calendar year (Ramey and Ramey, 2010; Guryan et al., 2008). Instead, I study how the age profile of investments changes across cohorts of children, separately for children of mothers with different educational attainment.

Taking a cohort-age approach uncovers novel evidence on the timing and the size of the relative change in investments between high- and low-skill mothers. In levels, childcare time spent by mothers of the 1970s was similar between high- and low-skill mothers. Starting with children born in the 1980s, the level of investments increased, especially for older children of high-skill mothers. For the cohorts born after the 1980s, the shape of the education gradient over the lifecycle becomes U-shaped, with the largest differences at younger and older ages. Starting with the cohorts born in the 1990s, the gradient at young ages has been widening across cohorts.

I then show evidence on the evolution of education-related spending in high- and low-skill households. For teenage children born in the 1980s and 1990s, the level of spending in high-skill households was much higher than for the previous cohorts. The trend continued for the subsequent cohorts, reaching an annual amount of $4,600 for the cohort born in the 2000s. For

young children, the trend throughout the period has been flat.

Finally, I present evidence supporting the role of information diffusion on the technology of skill formation. To document information diffusion, I construct *n-grams* from books published in the United States over the period 1960-2010. The availability of information on the importance of early child development increased fast between the mid-80s and the 1990s, in line with the timing of the increase in childcare time at very young ages.

In the second part of the paper, I introduce a two-period lifecycle model that can help understand some of the changes documented in the first part. I show that higher returns from investing in the child's human capital and higher household spending can increase the level of time investment in every period, but does not change the optimal ratio of time investments across periods. With perfect capital markets, the optimal ratio of childcare hours across periods mostly depends on the perceived parameters of the technology of skill formation. When complementarities over the lifecycle are high, parents will tend to equalize investments at every age, as it is the case for children of high-skill mothers in the 1980s. When complementarities over the lifecycle are high, and the productivity of investments is perceived to be higher in the early childhood stage, the optimal ratio of early to late investments will tend to increase, as it is the case for high-skill mothers in the 1990s and 2000s.

Finally, I test whether differences in the perceived parameters of the technology of skill formation exist between high- and low-skill mothers. I use the Child Development Supplement of the Panel Study of Income Dynamics (PSID) to provide evidence that high- and low-skill mothers have different beliefs on the importance of early relative to late investments, and that beliefs are predictive of actual behavior. The Child Development Supplement provides information on a cohort of children born between the 1990s up to the early 2000s. I document that the difference on the perceived importance of early relative to late investments across educational levels is large: mothers with a graduate degree are 77% more likely to believe in the long-lasting effects of early life conditions relative to high school dropouts, and have double the probability to

have ever breastfed. The results provides strong support for the hypothesis that mothers of the recent generations are likely to have different beliefs on the importance of early investments, which then translate into differences in outcomes.

Related Literature Time use data show that parents today spend more time in childcare activities relative to the past, especially the college-educated (Sayer et al., 2001; Ramey and Ramey, 2010). Ramey and Ramey (2010) are the first to document the widening of the education gradient in childcare hours in the late 1990s. Guryan et al. (2008) show that the relationship between parents' education and childcare time holds within and across countries, and speculate that the positive gradient is due to the investment nature of parental time, which differs from household production and leisure time. The literature proposed a number of explanations for the overall increase in childcare hours and the widening education gradient. These include, for example, competition for college admission (Ramey and Ramey, 2010), assortative mating in the marriage market (Chiappori et al., 2017; Lundberg and Pollak, 2014), and cultural differences between parents of different socioeconomic status (Lareau, 2011). However, the determinants of the increase in time spent with children are still little understood (Bertrand, 2018). I contribute by showing novel evidence on the evolution of childcare hours, and argue that information diffusion on the technology of skill formation can contribute towards explaining some of the increase in childcare time, especially at younger ages.

This paper is also related to the literature on the technology of human capital formation. Heckman's work on skill development challenged the traditional Beckerian view of childhood as a single investment period. Heckman builds upon evidence in psychology, education, and neuroscience to propose a multi-period model of skill formation in which human capital is formed at different stages, and there exist complementarities in investments across periods. Cunha and Heckman (2007) argue that gaps in cognitive abilities open up at very early stages in the child's development, and that the return from investing in cognitive abilities is highest at younger ages.

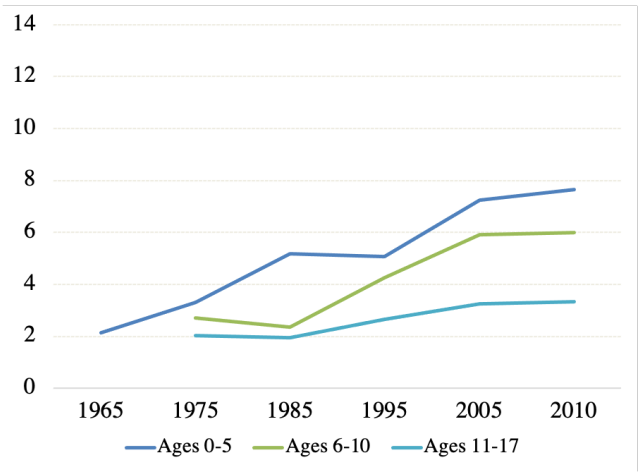
Early investments, however, need to be followed by later investments: dynamic complementarities between development stages produce a multiplier effect, and skills and abilities beget skills and abilities.[2]

The literature has estimated the parameters of the technology of skill formation. The consensus is that parental time is more productive at young ages (Cunha et al., 2010; Del Boca et al., 2014; Agostinelli and Wiswall, 2016). What matters for parental investments, however, is not the "true" production function of the child's human capital, but rather what parents believe the production function to be. This paper is related to empirical work documenting the role of informational frictions between parents of different socioeconomic status. By eliciting parents' preferences through hypotetical scenarios, Boneva and Rauh (2018) show that parents' beliefs are predictive of actual investment behavior, and that parental beliefs about the skill development process differ by socieconomic status.

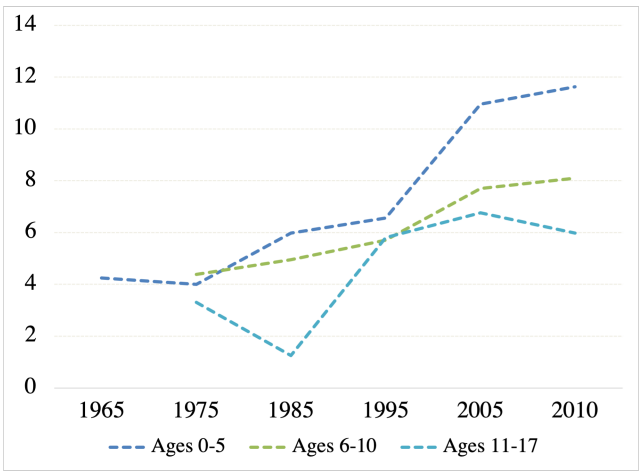
2 Motivating facts

I start by showing composition-adjusted means of weekly childcare hours, separately for high- and low-skill mothers and for children of different ages. Weekly childcare hours include time spent in non-basic care, such as playing, reading and talking to the child, or helping with homework. Figure 1 shows that childcare hours increased both for high- and low-educated mothers, but the increase has been more dramatic for high-educated mothers. Childcare hours increased fast for adolescent children (ages 11-17) in the late 1980s, and for younger children (ages 0-5) in the late 1990s.

[2] See Cunha et al. (2006) for an extensive discussion.



(a) Low-skill mothers

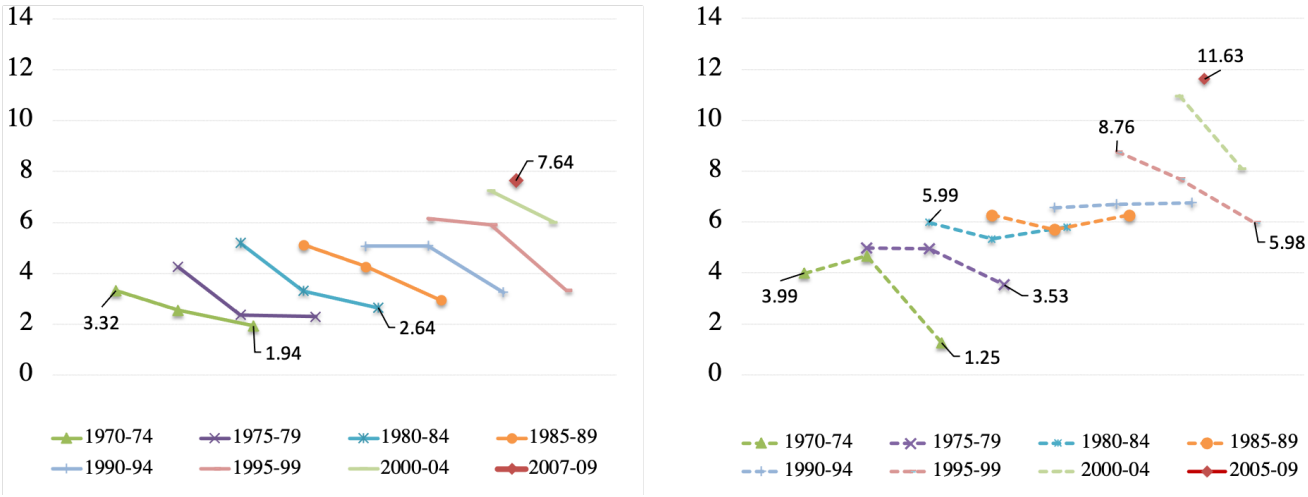


(b) High-skill mothers

Figure 1: Childcare hours, by child's age

Notes: AHTUS, 1965-2010. Predicted average weekly childcare hours spent by mothers by year of birth of the last child in the household. Predicted values are computed by regressing weekly childcare hours separately for mothers of children of different ages (0-5, 6-10, 11-16) on dummies for the calendar year, the mother's education tercile, the mother's age category (18-24, 25-34, 35-44, 45-54, 55-64), and a full set of interactions between the calendar year and education, and the calendar year and the mother's age. Composition-adjusted means are obtained separately for children of different ages in different years using a fixed set of weights for the mother's age category.

Time investments over the child's lifecycle In Figure 2 I rearrange the composition-adjusted means in Figure 1 to show the age profile of investments for children of different cohorts. Each line in Figure 2 represents a different cohort of children, and each dot within a line represents the child's age. Panel (a) of Figure 1 shows mothers at the bottom of the education distribution, and Panel (b) the top of the education distribution. For each cohort, high-educated mothers supply more childcare hours relative to low-educated mothers. Changes in childcare hours over time can be summarized by considering three groups of cohorts. For the first group, corresponding to children born in the 1970s, the age profile of investments looks similar between high- and low-educated mothers. The similarities arise both in levels and when looking at age profile over the lifecycle. The second group of children corresponds to the cohorts born between the 1980s and the early 1990s. Mothers of the cohorts born after the 1980s spend more time taking care of older children relative to the past. Such pattern is much



(a) Low-skill mothers (b) High-skill mothers

Figure 2: Childcare hours, by child's cohort

Notes: AHTUS, 1965-2010. Predicted average weekly childcare hours spent by mothers by year of birth of the last child in the household. Predicted values are computed by regressing weekly childcare hours separately for mothers of children of different ages (0-5, 6-10, 11-16) on dummies for the calendar year, the mother's education tercile, the mother's age category (18-24, 25-34, 35-44, 45-54, 55-64), and a full set of interactions between the calendar year and education, and the calendar year and the mother's age. Composition-adjusted means are obtained separately for children of different ages in different years using a fixed set of weights for the mother's age category.

more pronounced for high-skill mothers. For high-skill mothers, the age profile of investments looks flatter, and childcare hours equalize over the child's lifecycle. The third group of children corresponds to the cohorts born between the late 1990s and early 2000s. High-skill mothers increased substantially maternal care at young ages, whereas childcare hours increased at a low rate for low-skill mothers. With the most recent cohorts the divide in childcare hours has reached the largest size at every age in the child's lifecycle.

Figure 3 shows the implied differential in childcare hours, separately for different cohorts of children and over the lifecycle of the child. The estimated differentials confirm the main patterns shown by the composition-adjusted means in Figure 2. Controlling for employment status, the differences between high- and low-skill mothers amplify. For children born in the 1970s, the differential is insignificant over the lifecycle. For children born in the 1980s, large and significant differences show up at older ages. For the cohorts born after the 1990s, the age

profile of the education gradient becomes U-shaped, with the largest differences at younger and older ages. Starting with the cohorts born in the 1980s, the gradient has been widening across cohorts, and the intercept of the age profile has shifted upwards for the recent cohorts relative to the early cohorts.

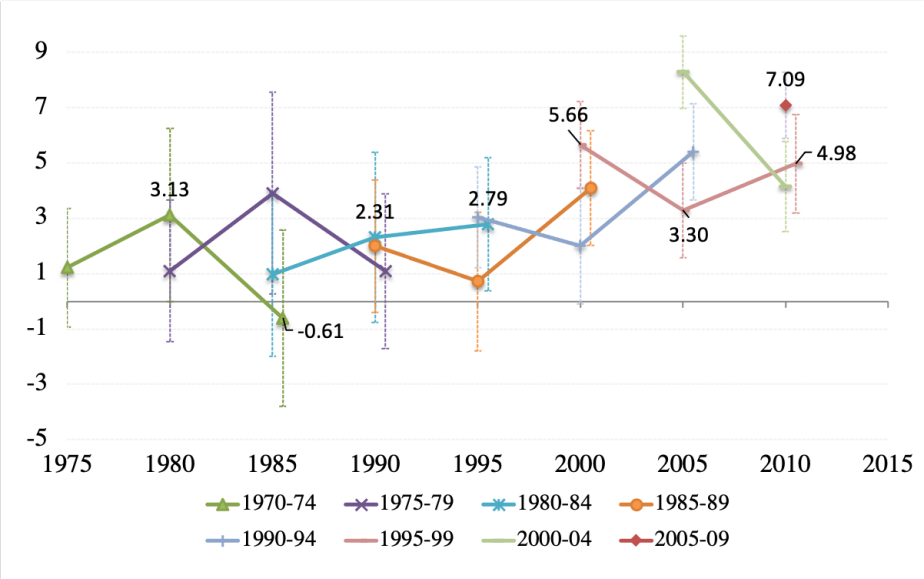
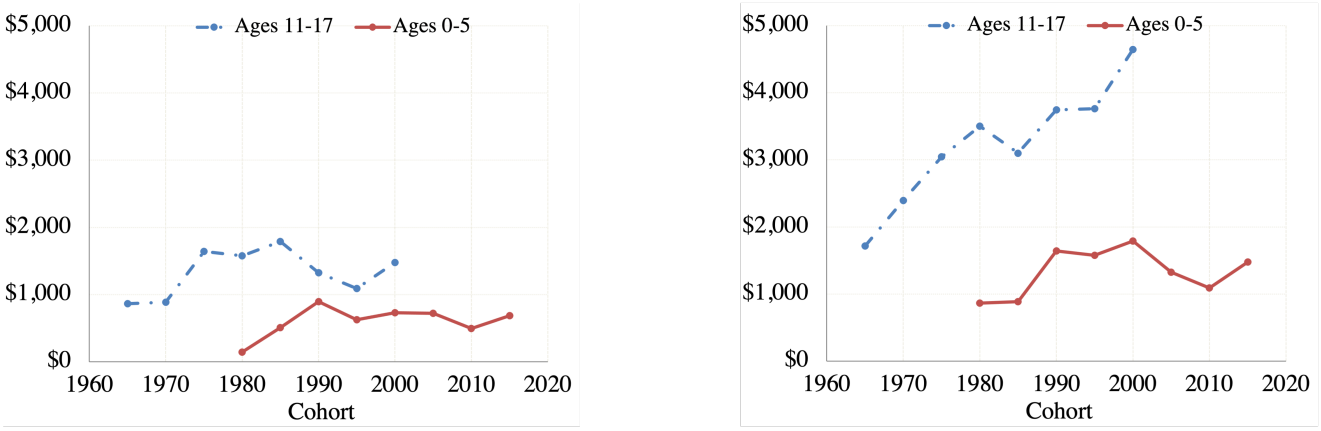


Figure 3: Gaps in childcare hours, high- vs low-skill mothers

Notes: AHTUS, 1965-2010. Differentials in weekly average childcare hours between mothers at the top tercile of the education distribution and mothers at the bottom tercile of the education distribution, by year of birth of the last child in the household and over the lifecycle of the child. Each dot represents a regression coefficient obtained by regressing weekly childcare hours separately for each cross section on dummies for the child's age category, dummies for the mother's tercile of the education distribution, a set of interactions between the child's age and the mother's education, and a set of controls (the mother's age category, race, employment status, marital status, number of children). The 90% confidence interval is plotted along with the coefficient. Since I do not observe every cohort at every age, missing age-year cells are obtained with a linear interpolation between adjacent age-year cells.

Increase in educational spending Parental spending in educational goods and activities is largest at old ages. Figure 4 shows the evolution of average annual household spending separately for low- and high-skill mothers, and for children of different cohorts and ages. Average annual spending is in thousands of 2010 dollars. The measure includes education-related expenditures, such as tuition, books and supplies, tutoring and other lessons, and expenditures on enrichment goods, such as books and magazines, musical instruments, and sports equipment.



(a) Low-skill mothers

(b) High-skill mothers

Figure 4: Average Annual Expenditures ($2010)

Notes: CEX, 1980-2015. Predicted average annual expenditures spent by households in which the mother is at the bottom tercile of the education distribution (Figure a) and at the top tercile of the education distribution (Figure b), by age of the last child in the household. See the Appendix for a full description of the methodology used.

For older children born in the 1980s and 1990s, the level of spending in high-skill households was much higher than for the previous cohorts. The trend has continued for the subsequent cohorts, reaching an annual amount of $4,600 for the cohort born in the 2000. For young children, the trend throughout the period has been flatter. Older children born in the 1980s and 1990s in low-skill households also experienced higher levels of spending relative to the older cohorts, but the amounts have been far from those spent in high-skill households. Similarly to their high-skill counterparts, for young children of low skill mothers the trend has been flat.

There are multiple reasons behind the increase in spending at older ages. First, the rise in income inequality starting from the late 1970s led to the divergence in spending possibilities between high- and low-educated households. If monetary investments are especially productive at older ages, an increase in parental resources translates into an increase in the level of spending on older children. The increase in demand for college education since the early 1990s may also have increased the productivity of monetary investments at older ages. Bound, Hershbein, and Long (2009) document that from 1992 to 2004 the number of college applicants grew by 44%, due to both increasing cohort size and rising fraction of high school graduates applying

for college. At the same time, the supply of college slots on the side of 4-year institutions did not keep pace with the increase in demand: undergraduate enrollment in top 20 private universities and top 20 liberal arts colleges increased by just 0.7% from 1986 to 2003 (Bound, Hershbein, and Long, 2009). The high increase in demand and the relative lack of supply is one of the reason for the large increase in university tuition costs (see Figure 5). High school students who intend to apply for college face pressure to signal their ability to college admission committees through performance in standardized tests, and involvement into extracurricular activities such as sports, music, volunteering, and participation to school clubs. Since the early 1990s competition for college admission became harsher, putting greater pressure on teenagers and their parents.

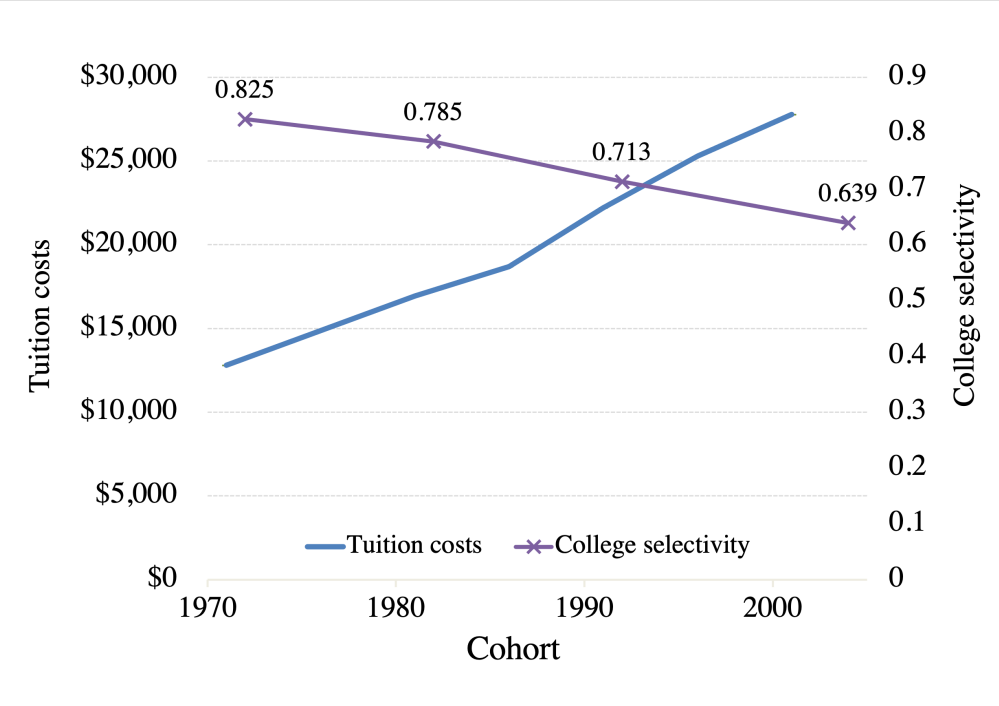


Figure 5: Tuition costs and college selectivity

Notes: Tuition costs in 4-year private and public institutions (National Center For Education Statistics, constant 2018-2019 dollars) and college selectivity (Bound, Hershbein, and Long, 2009). College selectivity in Bound, Hershbein, and Long (2009) is calculated as the counterfactual probability that a high school senior with the same average characteristics as in 1972 would be admitted to college in later years. The covariates used to calculate the counterfactual probability are test decile and regional indicators.

Complementarity between time and money For the cohorts of children born in the

1980s and 1990s, the level of spending increased at every age in high-skill households, especially for older children. If complementarities between time and money exist, the increase in educational and recreational spending in high-skill households can rationalize some of the increase in childcare hours found in time use data for older children of the 1980-1990 cohorts. Figure 6 shows evidence on the existence of some degree of complementarity between mothers' time and children's activities in recent years. The light line in Figure 6 shows the difference in childcare hours spent on older children between high- and low-educated mothers. The darker series in Figure 6 shows the difference in average time spent on homework and extracurricular activities by children aged 15-17, again by the mother's education. The series for children in Figure 6 is obtained using more recent data from the American Time Use Survey (ATUS), which can be merged with data from the Current Population Survey (CPS) to obtain the respondent's household characteristics.[3] The differentials estimated for children are conditional on family income, suggesting that the gradient in hours devoted to homework and extracurricular activities does not merely reflect differences in income.

[3]Control variables include the child's age, sex, race, the mother's age, employment status, marital status, and family income.

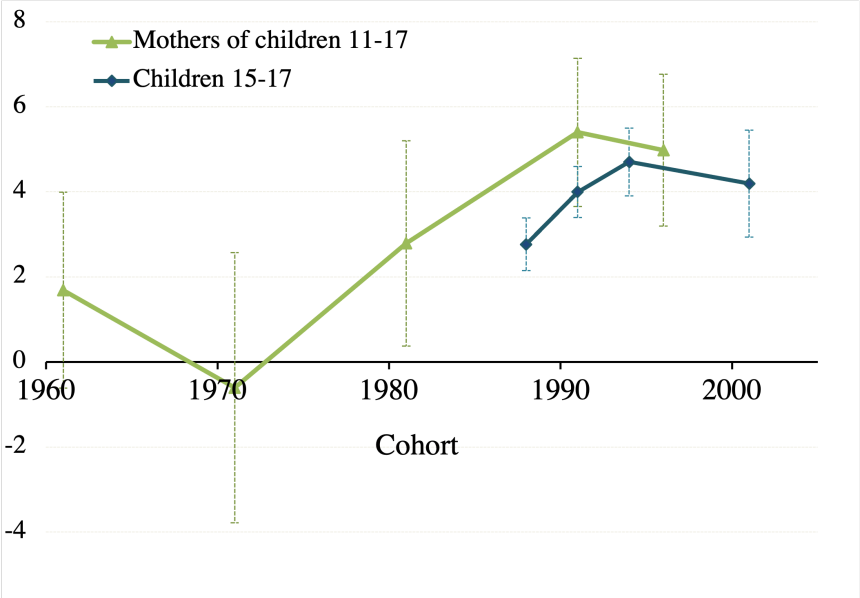


Figure 6: Older children: mothers' and children's time

Notes: Mothers of children 11-17: difference in childcare hours spent by mothers of children aged between 11 and 17, by skill level (high-low skill). The series is the same as the one shown in Figure 3 for children 11-17 (Source: AHTUS 1965-2011). Children 15-17: difference in homework and extracurricular hours spent by a sample of respondents aged 15-17, by the mother's skill level (high-low skill). Control variables include the child's age, sex, race, the mother's age, employment status, marital status, and family income (Source: ATUS 2003-2017, linked to CPS data to obtain household's characteristics).

Information on early child development, 1960-2010 I document changes in the availability of information on early child development using *n-grams* from books published in English in the United States over the period 1960-2010. *N-grams* are often used to calculate the occurrence probability of groups of words or phrases in publications. Figure 7 shows the top 10 word substitutions in the middle of the words "early" and "development". The expression "early childhood development" has been the top substitution starting from the mid 1970s, but the frequency of its occurrence increased fast between the late 1980s and the early 1990s.

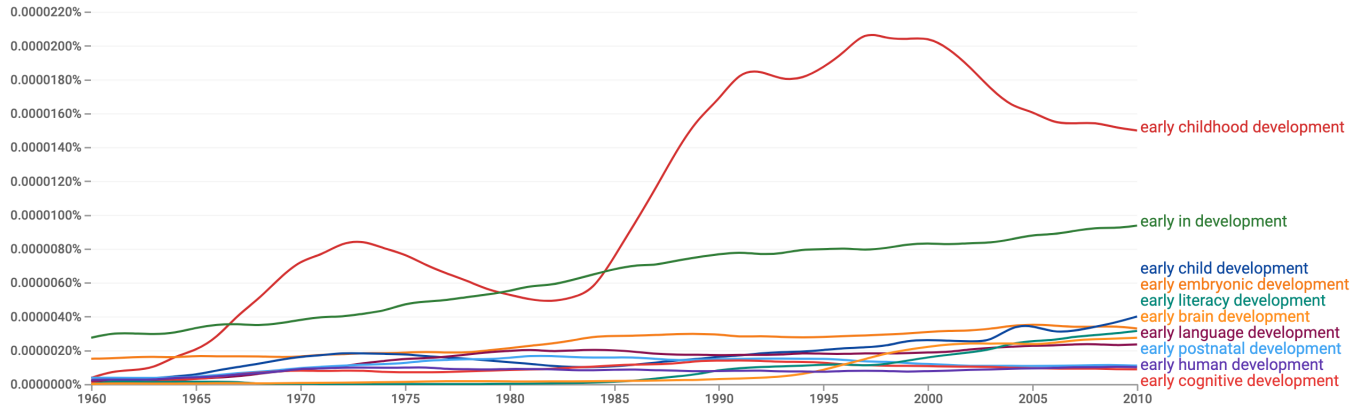


Figure 7: early – *word* – development

Notes: Source: Google's Books Ngram Viewer. Frequency of the top 10 substitutions for *word*. Books predominantly in the English language that were published in the United States, 1960-2010.

Figure 8 shows the dependency relation between the words "skills" and "early", namely the frequency with which the word "early" modifies "skills". Examples include "early literacy skills", "early skills", "early math and literacy skills". The frequency of the dependency between "skills" and "early" increased at a constant rate from the 1970s until the 1990s. From the mid 1990s, the dependency relation started becoming more frequent, and became 8 times more present in the early 2000s relative to its level in the 1990s.

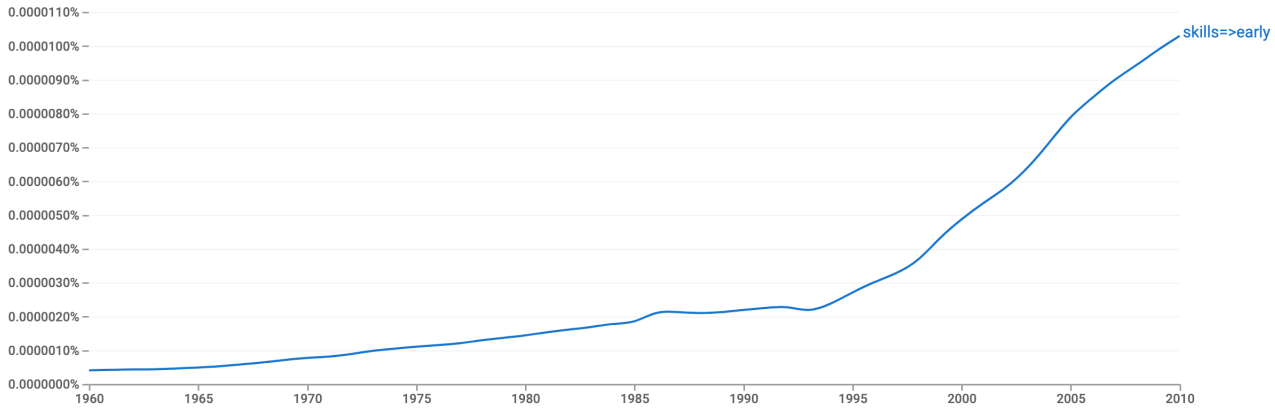


Figure 8: skills → early

Notes: Source: Google's Books Ngram Viewer. Dependency relation between the word *skills* and the word *early*. The series shows the frequency with which *early* modifies *skills*. These include, for example, *early literacy skills*, *early skills*, *early math and literacy skills*, and all the other instances in which the word *early* is applied to *skills*. Books predominantly in the English language that were published in the United States, 1960-2010.

3 A model of the lifecycle and human capital development

I provide a framework for understanding the changes in childcare hours, and the role of increasing returns from human capital, complementarity between time and money, and information diffusion on the technology of skill formation. The mother's problem lasts for two periods, corresponding to two different stages of the child's lifecycle, early and late. Mothers get utility from consumption, and the level of well-being of their child at the end of the second period, when child development is complete. Mothers are endowed with one unit of time, which they allocate between labor hours and childcare hours. In every period, mothers choose the optimal level of consumption and investment in their child. Mothers can borrow from the second period to finance consumption in the first period, but cannot leave negative savings to their child. When a child is born, a mother solves the problem:

$$\max_{c_1,c_2,X_1,X_2} \quad U(c_1,c_2,X_1,X_2) = u(c_1) + \beta u(c_2) + \beta^2 V(Q)$$

subject to the intertemporal budget constraint:

$$c_1 + \frac{c_2}{1+r} + wH_1X_1 + \frac{wH_2X_2}{1+r} = \left(\tau H_1 + \frac{H_2}{1+r}\right)w \tag{1}$$

where c_j represents consumption and X_j represents maternal investments in each period. Because the opportunity cost of X_j is the market wage w, X_j represents childcare time. H_j represents the skill premium for the mother in each period of her life. τ is a parameter that captures the fact that when the child is young a certain fraction of the mother's time must be devoted to basic care activities. The value of the child's well-being is given by $V(Q) = \xi^e \log Q$, where Q represents the child's human capital and ξ^e the return from the child's skill. Therefore, $V(Q)$ can be thought of as the present discounted value of the child's stream of future income. The child's human capital is produced combining investments in the first and in the second period

according to the production function:

$$Q = \left[\gamma X_1^{\phi} + (1-\gamma) X_2^{\phi}\right]^{\frac{1}{\phi}} \tag{2}$$

The CES production function allows to capture investments' self productivity, and complementarity across investments in different periods (Cunha and Heckman, 2007). Self productivity implies that investments in one period can augment investments at later periods. The parameter capturing self productivity is γ in Equation 2, where $0 < \gamma < 1$. The degree of complementarity across periods is represented by the parameter $\phi \in (-\infty, 1)$, capturing the extent to which early investments can be substituted by late investments, and viceversa. The first order conditions for the problem are:

$$u'(c_1) = \lambda \tag{3}$$

$$\beta u'(c_2) = \frac{\lambda}{1+r} \tag{4}$$

$$\beta^2 \xi^e Q^{-\phi} \gamma (X_1)^{\phi-1} = \lambda H_1 w \tag{5}$$

$$\beta^2 \xi^e Q^{-\phi} (1-\gamma)(X_2)^{\phi-1} = \frac{\lambda H_2 w}{1+r} \tag{6}$$

where λ corresponds to the multiplier associated with the intertemporal budget constraint. From the first order condition for consumption, it follows that setting $\beta = \frac{1}{1+r}$ implies that $c_1 = c_2$ at the optimum. From the first order condition for X_1 (or X_2), it is straightforward to see that increasing the return from the child's skill increases the mother's level of investments. Holding everything else constant, increasing ξ^e increases the marginal utility of consumption in every period. Because consumption falls in every period, the budget constraint implies that X_1 (and X_2) must increase. An increase in the return from the child's skill, ξ_e, increases the level of investment in every period, but does not change the optimal ratio across periods. From the first

order conditions of the problem, the optimal ratio of early to late investments is:

$$\frac{X_1}{X_2} = \left[\frac{\gamma}{(1-\gamma)(1+r)}\right]^{\frac{1}{1-\phi}} \tag{7}$$

This expression is independent from the return from the child's skill, ξ^e. With perfect capital markets, the optimal investment ratio across periods only depends on the parameters of the production function and the real rate, r.

Time and money The production function in Equation 2 can be augmented to allow for complementarity or substitutability between time and money at different stages of the life cycle. In particular, I set the levels of investments in every period X_j, for $j = 1,2$, equal to a composite of parental time and monetary resources:

$$X_j = \left[\omega_j t_j^{\zeta_j} + (1-\omega_j) m_j^{\zeta_j}\right]^{\frac{1}{\zeta_j}} \tag{8}$$

where t_1 and m_1 denote time and money in period 1, and t_2 and m_2 denote time and money in period 2. The choice variables now become the optimal amounts of consumption, childcare hours, and monetary resources in every period. From the first order conditions, the optimal ratio between the optimal time and money in period j is:

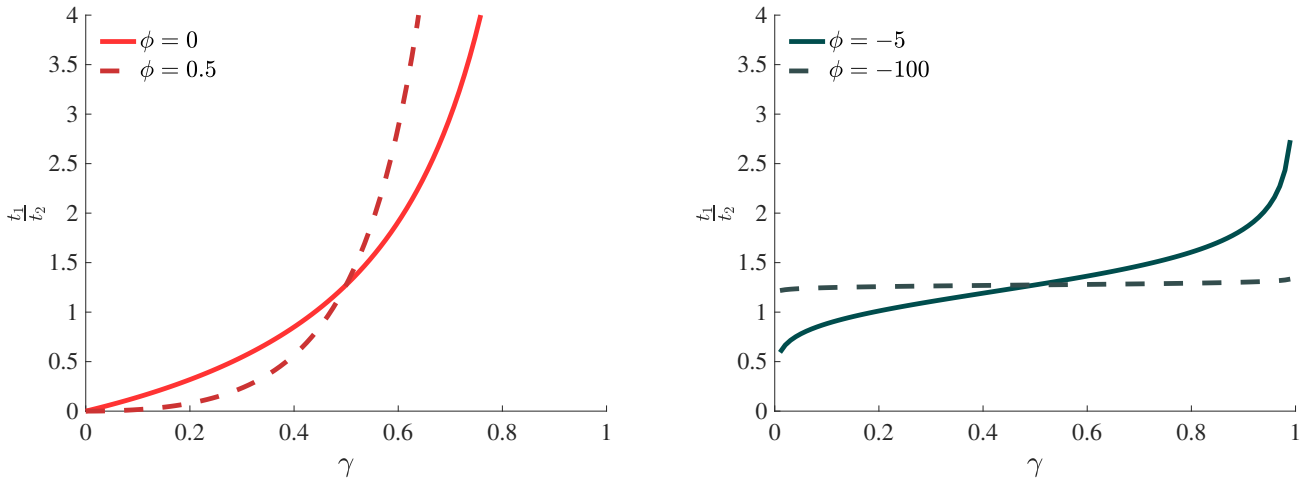
$$\frac{t_j}{m_j} = \left(\frac{\omega_j}{w(1-\omega_j)}\right)^{\frac{1}{1-\zeta_j}} \tag{9}$$

Setting $\zeta_j < 0$ implies that there exists some degree of complementarity between time and money in every period: when monetary investments are high, time investments will tend to be high as well, and viceversa. From Equation 9, the higher the opportunity cost of maternal time w, the less the share of time resources over total investment in period j. For simplicity, I set $\zeta_1 = \zeta_2 = \zeta < 0$, so that complementarity between time and money is the same in the two periods.

The optimal ratio of maternal time across periods becomes:

$$\frac{t_1}{t_2} = \left[\frac{\gamma}{(1-\gamma)(1+r)}\frac{\omega_1}{\omega_2}\right]^{\frac{1}{1-\zeta}} \left(\frac{X_1}{X_2}\right)^{\frac{\phi-\zeta}{1-\zeta}} \tag{10}$$

Figure 9 shows the optimal ratio of early to late childcare time when mothers' investments are perceived as substitutes (Panel a) or complements (Panel b) across periods, as a function of the productivity of early investments, γ. Panel (a) shows that when investments across periods are substitutes, mothers will allocate more time whenever it is perceived as more productive: the higher the productivity of early investments γ, the higher the optimal ratio of early to late childcare time. When investments over the lifecycle are complements, instead, the optimal ratio of early to late investments goes to one, for any level of γ. When complementarities over the lifecycle are high, parents equalize investments at every age, and the productivity of early investments γ plays a less important role.



(a) Substitutability (b) Complementarity

Figure 9: Optimal ratio of early to late time investment, as a function of γ

Notes: $\zeta = -3$, $\omega_1 = 0.8$, $\omega_2 = 0.3$, $r = 0.01$.

Figure 9 and the model provide a sufficient framework for understanding the role of complementarities between money and time and across the lifecycle towards rationalizing some of

the changes documented in the first part of the paper. To make the exposition easier, in Table 1 I group cohorts of children into 10-year intervals, and only focus on investments at ages 0-5 ("Early") and ages 11-17 ("Late").

Table 1: Ratio of early to late childcare time

	Low-skill mothers				*High-skill mothers*			
Child born:	1970	1980	1990	2000	1970	1980	1990	2000
Childcare hours:								
Early (ages 0-5)	3.78	5.15	5.60	7.44	4.49	6.13	7.66	11.29
Late (ages 11-17)	2.12	2.79	3.29	3.77	2.39	6.04	6.37	5.27
Ratio E/L	1.79	1.84	1.70	1.97	1.88	1.01	1.20	2.14

Notes: Source: AHTUS, 1965-2000. Childcare hours are the same as in Figure 2, aggregated in 10-year cohorts instead of 5-year cohorts. For children of ages 11-17 of the 2000 cohort, childcare hours are from the ATUS, 2003-2017.

Table 1 shows the evolution of childcare hours for children of different cohorts, in the early and late stages of their lifecycles.

Substitutability across the lifecycle (1970 cohort) In the 1970s, the availability of information on the complementarity of investments across different stages of the lifecycle was low, and the wage premium for the college-educated was modest. The investment behavior of high- and low-skill mothers of children born in the 1970s was quite similar, with large differences in spending documented especially for older children. Table 1 shows that for children born in the 1970s, time investments are high at young ages, and low at older ages. The opposite is true for money: monetary investments are low at young ages, and high when the child is older. The pattern is consistent with the existence of some degree of substitutability between investments across the lifecycle. The existence of some degree of substitutability in investments across periods implies that mothers will intensify their investments whenever they are perceived as more productive. As shown by Figure 9, when $\phi > 0$ and the productivity of early investments is perceived to be high, mothers will spend more time on young children, and $\frac{t_1}{t_2} > 1$. The existence

of substitutability between investments across the lifecycle and the fact that maternal time is perceived to be more productive at young ages will make mothers more willing to spend time with their children early on, and delay monetary investments to later stages. This investment behavior is consistent with a number of studies finding that time investments are more productive at younger ages, whereas monetary investments are usually more productive for older children (see for example Del Boca, Flinn, and Wiswall (2014)).

Focus on older children (1980-1990 cohorts) In the period 1980–1990, the availability of information on the complementarity of investments across different stages of the lifecycle becomes more abundant. At the same time, monetary investments at older ages increase considerably, especially for high-skill parents. Complementarities between time and money in the production of late investments – X_2 in the model – push up childcare hours spent on older children (see Equation 9). At the same time, the greater availability of information on the complementarity of investments across the lifecycle tends to equalize time across the lifecycle. Greater availability of information on the complementarity of investments maps to a decrease in ϕ– the parameter governing the degree of complementarity between investments over the lifecycle. The Appendix shows how the optimal ratio of maternal time across the two stages of the lifecycle changes as the level of parents' investments and the degree complementarity between investments across the lifecycle increase at the same time.

Focus on young children (2000 cohort) In the late 1990s and early 2000s, the growth in income inequality keeps increasing, albeit at a lower rate. In the same time period, information diffusion on the complementarity across investments and the importance of early skill development accelerates. As shown by Figure 9, a further decrease in the parameter ϕ – governing degree of complementarity between investments over the lifecycle – would not suffice to rationalize the large increase in mothers' time spent on young children. The increase in mother's

hours at young ages can be rationalized through a change in the perceived values of γ and ω_1 (or ω_2), which reflect the productivity of investments at early ages. In the next section, I provide evidence corroborating the existence of different beliefs on the importance of early investments

4 Do high- and low-skill mothers have different beliefs on human capital formation?

I provide evidence on the existence of different beliefs on human capital formationof betweeen high- and low-skill mothers.[4] I use data of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID), which contains detailed information on a sample of children and their parents. The available information includes, for example, test score data, children's time diaries, and the response to a large number of questions asked to parents. I focus on the perceived importance of early investments by analyzing the likelihood to agree to the following statement: *"The way a parent treats a child in the first four years has important life-long effects."* I also focus on differences in breastfeeding rates between mothers of different educational attainment. Although breastfeeding represents a measure of actual behavior rather than a belief, it is suggestive of the existence of different early child-rearing attitudes between high- and low-skill mothers. Table 2 shows that high-skill mothers are more likely to believe in the importance of early investments, and that the gradient monotonically increases with the mother's level of education. All the regressions control for family income, so that the correlations should not be thought of as merely capturing the effect of wealth. The differences are very large: for example, mothers with a graduate degree are 77% more likely to believe in the long-lasting effects of early life conditions relative to high school dropouts, and have double the probability to have ever breastfed.

[4] A similar question has been answered by Boneva and Rauh (2018) and Cunha et al. (2013), who focus on a sample of UK parents and disadvantaged African American mothers respectively. Attanasio et al. (2019) study whether parents in the UK perceive time and material investments to be complements or substitutes in the production of human capital.

Table 2: Importance of Early Investments

	First 4 years have long-lasting impact:		
	Strongly Agree	Agree	Ever breastfed
	(1)	(2)	(3)
Graduate	0.109***	0.055***	0.346***
	(0.021)	(0.022)	(0.046)
Bachelor's	0.082***	0.027	0.235***
	(0.016)	(0.018)	(0.035)
Some College	0.019*	0.011	0.065***
	(0.011)	(0.011)	(0.023)
Individual-level controls	Y	Y	Y
Child's cohort FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	6224	6224	2963
Mean of dep.var. in reference group	0.142	0.282	0.333

Notes: Source: Child Development Supplement of the PSID, 1997-2007. Sample: mothers of children aged under 19. Individual-level controls include the child's age, mother's education, marital status, age, number of children, employment status, and family income. Standard errors are clustered at the location-year level. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

In Table 3 I check whether mothers' beliefs correlate with actual behavior, and regress total weekly childcare spent on very young children on the belief measure. I find that beliefs correlate positively with time spent with young children: for both measures, mothers who agree with the statement spend between 2.5 and 3 hours more with their young children relative to mothers who do not agree. When controlling for beliefs the coefficient on the mother's skill level turns insignificant. The point estimate on the indicator for mothers with a graduate degree is large, but it is imprecisely estimated. Far from capturing a causal effect, these results are nevertheless suggestive that beliefs are important predictors of actual behavior.

Table 3: Importance of Early Investments and Total Childcare Time

Dependent Variable: Total Weekly Childcare Hours	(1)	(2)
First 4 years important, strongly agree	2.487***	
	(0.711)	
First 4 years important, agree		2.974***
		(0.711)
Graduate	1.863	2.081
	(1.710)	(1.700)
Bachelor's	-0.032	0.077
	(1.302)	(1.297)
Some College	0.234	0.252
	(0.864)	(0.862)
Individual-level controls	Y	Y
Child's cohort FE	Y	Y
Year FE	Y	Y
Observations	1,695	1,695
Mean of dep.var. in reference group	21.716	20.869

Notes: Source: Child Development Supplement of the PSID,1997-2007. Sample: mothers of children aged under 6. Individual-level controls include the child's age, mother's education, marital status, age, number of children, employment status, and family income. Standard errors are clustered at the location-year level. $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

5 Conclusion

This paper revisits the evidence on the evolution of mothers' childcare time over the period 1970-2000. Whereas for the low-educated the increase in childcare time has been rather homogeneous for children of different ages, for the high-educated the change been heterogeneous at different ages. For high-educated parents of children born in the 1980s, the relative focus was at older ages. For children high-educated parents of the recent generations, childcare time is much higher at young ages. I then present evidence on contemporaneous trends that may offer candidate explanations for the change in childcare time: the increase in spending and the availability of information on the importance of early child development. Finally, I present a stylized

model that helps understand which parameters may have changed in order to rationalize the observed trends.

My results show that informational frictions may result in large and persistent differences: parent's time is crucial for children's wellbeing, school performance, and intergenerational mobility (Del Boca, Flinn, and Wiswall, 2014; Daruich, 2019). My paper suggests that policies aimed at raising awareness on the importance of early life experiences among parents from less advantaged backgrounds can be an effective solution to close some of the gap in childcare time between high- and low-skill mothers.

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A Appendix

A.1 Data

Historical Time Use Data Time use data are from six cross-sections of the American Heritage Time Use Survey (AHTUS), covering the period 1965-2010.[5] The main sample includes mothers aged 18-64 who have completed education and whose eldest child in the household is aged less than 18.

Time Use Data I use data from the American Time Use Survey (ATUS) 2006-2017 to study the relative productivity between time of high- and low-skill mothers. The sample includes mothers of children aged less than 18. The ATUS sample is drawn from the CPS sample two months after completion of the eight CPS interview. Time diaries data are available only for one respondent in each household.

Spending Data To document changes in parental spending I use eight cross sections from the Consumer Expenditure Survey (CEX), 1980-2015. [6] The sample includes mothers aged 18-64 whose oldest child in the household is aged below 18 years and who have completed education. Total spending is adjusted for inflation to 2010 dollars and is defined as the sum of the following categories: education expenditures (tuition, books and supplies, tutoring activities and other lessons), equipment expenditures (musical instruments and sports equipment), and expenditures on books and magazines. The exact breakdown of the expenses by year is shown below.

Immigration Data I use data from the American Community Survey (ACS) 2006-2017 and Census data for 1990 to construct yearly immigration measures and the Bartik instrument. I merge immigration data with the ATUS at the county level. Whenever the county is not identifiable either in the ATUS or in the Census, I merge the data at the metropolitan area level. Low-skill immigrants are defined as foreign-born individuals who have not completed high-

[5] These include the years 1965, 1975, 1985, 1995, 2005, and 2010.
[6] These include years 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015.

school. When calculating the intensity of low-skill immigration over total population, I only consider individuals aged 25-54. To construct ancestry shares in 1990 – the “share" part of the instrument – I use information on ancestry whenever there exists a one-to-one mapping with country of origin. For the “shift" part of the instrument, I use information on country of origin and include individuals that migrated to the US between the previous decade and the current year.

Beliefs Data Data on mothers' beliefs are from the Child Development Supplement of the Panel Study of Income Dynamics. I focus on mothers of children aged under 19.

A.2 Methodology

A.2.1 Time

I distinguish between three distinct periods in the lifecycle of the child; these correspond to ages 0-5 (infants and kindergarten years), ages 6-10 (primary school), and ages 11-16 (middle school and high school). I analyze how parental investments evolved for different generations of mothers and children, with the idea that whenever a child is born, a new mother is also born. Therefore, I treat mothers of children born in different periods separately, and group cohorts of mothers/children in 5-year intervals.

The AHTUS provides information on the exact age of the youngest child in the household. Therefore, pseudo-cohorts can only be build based on the age of the youngest child in the household.[7] Consistently with previous literature[8], I define as parental time the time spent in active interaction with the child (e.g. playing, doing sports with the child, reading and talking to the child, helping with homework), the time spent taking (active) basic care of the child (e.g.

[7] Price (2008) shows that parents spend on average less time with children of higher birth orders (i.e. those who are born later). Therefore, the analysis may be underestimating total parental time in levels. However, to the extent that higher and lower educated parents reduce time investments on children of higher birth orders proportionally, the results on parental gaps should not differ much when looking at children of lower birth orders. As a robustness check, I run the analysis for one-child families only. The results are similar, especially for the latest cross-sections. For the early cross-sections the estimates are very noisy due to very small sample sizes.

[8] See Ramey and Ramey (2010), and Guryan et al. (2008).

feeding, medical care), and chauffering time. A complete list of all the activities included is shown in Table **??** in the Appendix.

I create composition-adjusted means to account for changes in parental hours that are due to the changing composition of the sample rather than mothers' behavior. In particular, I keep the age composition of mothers constant over time; very similar results are obtained if in addition I keep constant the share of mothers with children younger than 5 and children older than 5.
I divide mothers into three groups according to the age of their youngest child. I run the following regression separately for mothers whose youngest child belongs to age group g (g = 0-5, 6-10, 11-16):

$$\text{Total Childcare}_{it} = \alpha + \beta_1 \text{tert3}_{it} + \beta_2 \text{tert2}_{it} + \sum_{j \neq 1980} \gamma_j \cdot I(t=j) + \sum_{j \neq 1980} \delta_{1t}[tert3_{it} \times I(t=j)] + \sum_{j \neq 1980} \delta_{2j}[tert2_{it} \times I(t=j)] + \sum_{l} \eta_l \cdot I(a=l) + \sum_{j \neq 1980} \sum_{l} \eta_{jl}[I(a=l) \times I(t=j)] + \epsilon_{it} \quad (11)$$

where tert3_{it} and tert2_{it} represent respectively indicator variables for whether mother i belongs to the the third and the second tercile of the education distribution; $I(t=j)$ represents a year dummy, and $I(a=l)$ represents an indicator variable for whether mother i's age belongs to age group a (a=18-24, 25-34, 35-44, 45-54, 55-64). For every child's age group g, average childcare hours are predicted in every year for mothers of each education tercile and each age group a; the year×education×age cells are then aggregated using a fixed set of weights for the mother's age.

I use a richer specification to document the evolution of *gaps* in parental hours for children of mothers with different educational attainment. Instead of running separate regressions for mothers of children belonging to different age groups, I allow every coefficient to be cross-

section specific.[9] Therefore, in each cross section I run the following regression:

$$\begin{aligned}\text{Total Childcare}_i = \alpha + \beta\,\text{tert2}_i + \gamma_1\,\text{age 6-10}_i + \gamma_2\,\text{age 11-16}_i + \\ \eta_1\,\text{tert2}_i \times \text{age 6-10}_i + \eta_2\,\text{tert2}_i \times \text{age 11-16}_i \\ + \delta_1\,\text{tert3}_i + \delta_2\,\text{tert3}_i \times \text{age 6-10}_i + \delta_3\,\text{tert3}_i \times \text{age 11-17}_i + x_i'\eta + \epsilon_i \quad (12)\end{aligned}$$

where i is the index for the mother, age 6-10$_i$ is a dummy variable for whether the mother's youngest child is aged 6-10, age 11-16$_i$ is a dummy for ages 11-16, and tert2$_i$ and tert3$_i$ represent respectively dummy variables for the second and third tercile of the education distribution. x_i is a vector of controls, which includes the mother's age category, marital status, race, the number of children aged less than 5, number of children older than 5, the employment status (full time, part time, not employed), and the sample year (if the cross-section is obtained by pooling together more than one sample year). In this regression, the coefficients of interest are represented by δ_1, δ_2, and δ_3. These represent the gaps in parental hours between mothers at the top and at the bottom of the education distribution in each cross section for children aged 0-5 (δ_1), children aged 6-10 ($\delta_1 + \delta_2$), and children aged 11-16 ($\delta_1 + \delta_3$).

A.2.2 Spending

I obtain composition-adjusted means to show the evolution of parental spending over time. The CEX provides information on the level of education of both parents, as well as the age of each member in the household. For consistency with the AHTUS, I construct pseudo-cohorts of children who are the youngest in their household. Similarly to the AHTUS, I divide mothers into three groups according to the age of their youngest child in the household. I run the following regression separately for households in which the youngest child is in age group g (g = 0-5,

[9] The main advantage of this methodology is that I can avoid dropping from the regression control variables that are present in the AHTUS in certain years but absent in others. For example, the race variable is absent in 1985, marital status, the number of children older than 5, and the number of children older than 5 are absent in 1995.

6-10, 11-16):

$$\text{Total Spending}_{ht} = \alpha + \beta_1 \text{tert3}_{ht} + \beta_2 \text{tert2}_{ht} + \sum_{j \neq 1980} \gamma_j \cdot I(t=j) + \sum_{j \neq 1980} \delta_{1t}[tert3_{ht} \times I(t=j)] + \sum_{j \neq 1980} \delta_{2j}[tert2_{ht} \times I(t=j)] + \sum_{l} \zeta_l \cdot I(a=l) + \sum_{j \neq 1980} \sum_{l} \zeta_{jl}[I(a=l) \times I(t=j)] + \eta_1 \log(\text{income})_{ht} + \sum_{j \neq 1980} \eta_{2j}[\log(\text{income})_{ht} \times I(t=j)] + \epsilon_{ht} \quad (13)$$

where tert3_{ht} and tert3_{ht} represent respectively dummy variables for whether the mother in household h at time t belongs to the top tercile or the middle tercile of the education distribution in year t; $I(t=j)$ represent a dummy for year $t=j$, $I(a=l)$ represent an indicator variable for whether the mother's age belongs to group a (a=18-24, 25-34, 35-44, 45-54, 55-64), and $\log(\text{income})_{ht}$ represents the log of family income in household h at time t. Average spending is predicted in every year for each education tercile and each age group, holding income constant at the median in the cross-section. The year×education×age cells are then aggregated using a fixed set of weights for the mother's age.

I use a richer specification in order to document *gaps* in spending between households according to the mother's level of education. In particular, I add covariates and pairwise interactions between the covariates and the calendar year to the specification in equation 13, where the covariates include the mother's race, employment status, marital status, and number of children.

A.3 Additional Figures

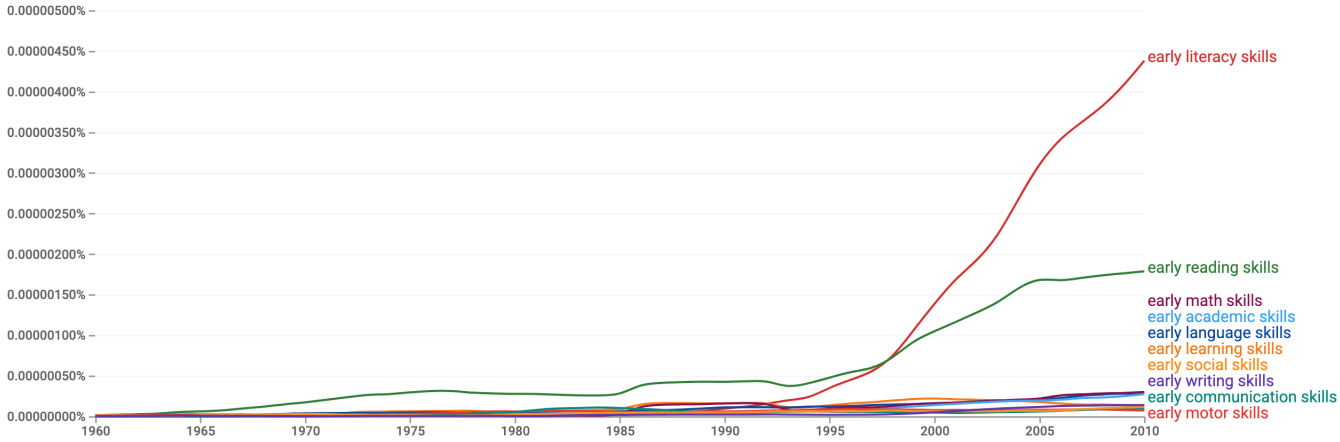

Figure A.1: early – *word* – skills

Notes: Source: Google's Books Ngram Viewer. Frequency of the top 10 substitutions for *word*.
Books predominantly in the English language that were published in the United States, 1960-2010.

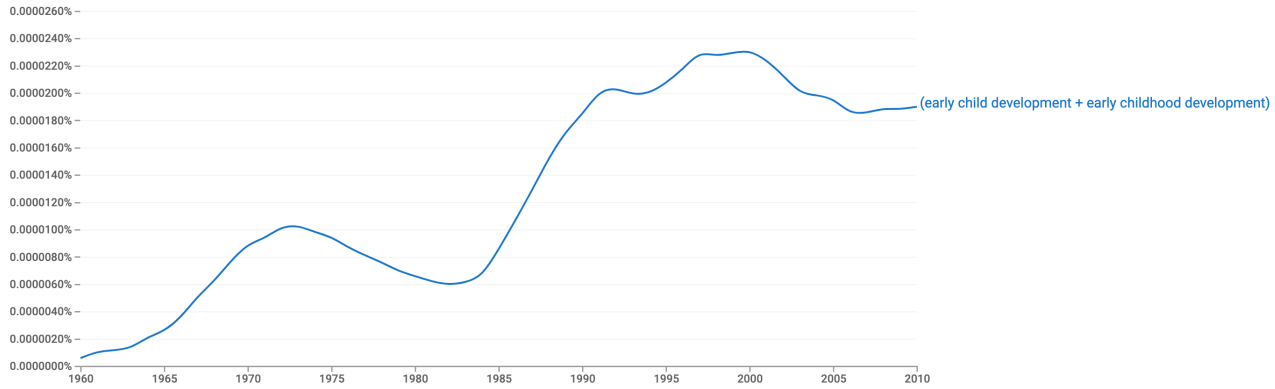

Figure A.2: "early child development" – "early childhood development"

Notes: Source: Google's Books Ngram Viewer. Frequency of *early childhood development* and *early child development*.
Books predominantly in the English language that were published in the United States, 1960-2010.